

# Research Challenges for Cartography in the Era of Big Data

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**Abstract:** New sources of geographic information are challenging existing methodological, technical, and design paradigms in cartography. The era of big data has arrived, and new cartographic research is required in order to evolve the science, art, and technology of mapping to suit the challenges associated with big data volume, velocity, variety, and veracity. In this paper we explore the new landscape of research challenges and opportunities for cartography in the big data era.

**Keywords:** Geovisual Analytics, Geovisualization, Big Data, Research Challenges, Art, Cartography

## 1. Cartographic Research and Big Data

The rapid pace of contemporary developments in cartographic design, science, and technology comes at a time when new and massive sources of spatial and spatio-temporal data are emerging simultaneously. High resolution imagery, stream-

ing social media, and the rise of the Internet of Things are just a few examples of big spatial data that beg for new forms of cartographic engagement.

In this paper we explore the new landscape of research challenges and opportunities for cartography in the big data era. We characterize challenges as key long-term problems that will require significant attention from multiple angles and collaborative teams, and we propose opportunities as smaller-scale issues that could be tackled in the near-term through directed studies by individuals.

Our research agenda was developed through a multi-phase collaboration with an international cohort of academic cartographers. An initial ideation phase via web-based discussion and voting led to the development of major topics which served as the impetus for a pre-conference workshop at the 2015 International Cartographic Congress in Brazil. Workshop attendees then developed a set of key research challenges and opportunities, along with a structure for presenting those ideas. Finally, a full article was developed by nine co-authors for publication.

Key attributes of big data include its volume, velocity, variety, and veracity, and our research agenda proposes new avenues for cartographic investigation in each of these areas. We also propose research goals for making sense of big data in the overall context of cartography. Our proposed research priorities also reflect both the scientific as well as the artistic dimensions of contemporary cartography. Big data pose major computational and representational challenges to mapmakers, and tackling those issues will require both technical as well as creative advances in the state of the art. We highlight challenge areas in terms of methodological avenues for cartographic inquiry, including the development of new representational, computational, and artistic approaches.

Furthermore, we call for future advances in cartographic research that achieve key scientific goals in concordance with major social and environmental challenges that impact our contemporary world. New approaches to mapping and our understanding of cartography should result in maps that matter – maps that can drive (rather than simply react to) meaningful change and engage new audiences. The United Nations proposes a set of major global goals via the 2030 Agenda for Sustainable Development that suggest key contexts in which cartographic advances could make a difference to society. We therefore call for cartographic research that speaks directly to these imperatives and encourages high impacts for people and our environment as much as it encourages the growth of our art and science.

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## References

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